

even-handed view of the Suleman situation. For example, tending to eight infants at once as a single mother is an idea worth experiencing rather than just pondering. Perhaps the most interesting aspect of the game has nothing to do with its journalistic quality, but with its context: a marketing agency rather than a news organization chose to produce and distribute it. The three types of current event games suggest a continuum, from tabloid sensationalism, through balanced reportage, to the biased conviction of editorial. Within this spectrum, newsmakers will have to make deliberate investments, lest the potential for earnest counsel in current event games become subsumed by crass marketing.

3 Infographics

"If you ever wanted to control where your tax dollars go, here's your chance to decide," proclaims *Budget Hero*, a game created by American Public Media. *Budget Hero* challenges players to plan for the nation's future by picking and choosing programs that reduce or raise government spending while avoiding excess debt and fulfilling player-chosen promises. Play involves reallocating funds from different budget categories, each allotment altering a twenty-year projection of the country's financial situation. Since budgets imply values, the player chooses goals in the form of "badges," among them health and wellness, national security, economic stimulus, and efficient government. The game judges the player's performance based on how well these chosen areas are developed over time.

Budget Hero's interface is a bar graph drawn to look like a cityscape (figure 3.1). It uses the skyline bar graph as a metaphor for the nation's health, stability, and size. By raising and lowering the constituent structures, the player helps to "define tomorrow's skyline." When the player clicks on a building, the game reveals a series of cards with budgetary subitems. One might choose to "Bring troops home soon" to save \$210 billion, fund "diplomacy and foreign aid" at the cost of \$390 billion, "increase mass transit funding" for \$33 billion, or give a "tax break for first time home buyers" at the expense of \$4 billion. There are 154 policy options in all.

The heights of the buildings change when the player selects a card or drags a marker across a timeline, displaying the projected budget over a twenty-year period. Players can see their progress on three meters measuring the deficit/surplus level, the relative size of the government, and the national debt. Another display shows the "Budget Bust," the year when the combined costs of health care, Social Security, and debt interest overtake revenue, breaking the bank. After selecting budget options, the player submits the budget to see what results it would produce. The game then

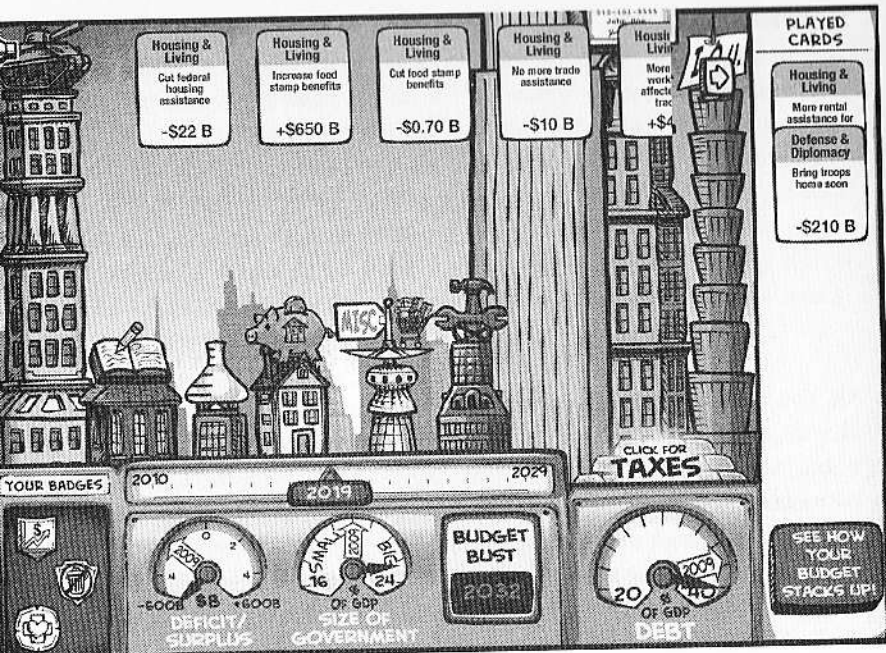


Figure 3.1

Budget Hero dresses up a simple bar graph of government spending in a city skyline adorned with symbolic illustrations. Success is measured not only by a balanced budget, but by how well the player lives up to chosen values, indicated by the “badges” at right.

passes judgment on the budget, evaluating the three categories just mentioned, as well as the goals chosen at the start of the game. The player can then go back and tweak settings to achieve better scores or to fulfill more completely the promises represented by the badges.

Budget Hero extends beyond the cityscape as well. American Public Media provides detailed explanations about its assumptions on the Web site that hosts the game, including an extensive FAQ that discusses how they got their numbers, why different categories were chosen or omitted, and how results were calculated.¹ They also describe the uses of data culled from playthroughs of the game, analyzing trends such as player demographics, the most frequently pursued badges, popular bipartisan badges, and the policies and decisions that most players enacted.

At its heart, *Budget Hero* is a spreadsheet with a fancy skin. It is but one of many types of *information graphics* or *infographics*—visual depictions of data used for reasoning about information.² *Budget Hero* offers a good

example of what can make an infographic playable. With its bar graph and timeline, it incorporates a deep data set that can be manipulated on multiple axes. The graphical display itself is dynamic, changing in real time to provide visual feedback. One does not manipulate the display haphazardly, but with a goal in mind: a budget with the greatest longevity and highest compatibility with player values. It is an example of *directed activity*: a graphic that guides the user through the information so that the component parts can be synthesized for understanding. The measures of success—deficit/surplus, government size, and national debt—provide universal goals, while the badges make the effort of playing personally relevant. And it offers an example of *free-form exploration*, thanks to the large space of information around the game’s primary goals of budget longevity and badge values. Replaying the game encourages the user to explore the depths of the data, examining the causes and effects of decisions or trying out different badge goals. The sheer number of possible priorities that arise from replay may make the game’s most important statement about the national budget: it’s complex, and riddled with conflict.

Infographics and Journalism

To understand the relationship between infographics, journalism, and play, it is useful to look at the history of the infographic’s form and function. Infographics have appeared regularly in the news since the late 1930s.³ It was *USA Today* who popularized the infographic among newsreaders with their “Snapshots,” graphics appearing in a sidebar below the fold on the front page of every issue. Compiled from national surveys, the daily snapshot usually displays the results in a simple fashion that visually evokes the topic in question. For example, a snapshot printed in the November 24, 2008, *USA Today* explains changes in radio listening habits among 14- to 24-year-olds, based on a survey.⁴ The results are rendered as a pie chart on the circular top of a studio broadcast microphone. Though the infographic makes for front-page eye candy, *USA Today* hardly takes full advantage of this technique as a tool for explaining issues.

Statistician and information designer Edward Tufte helps us understand why. Whether artist-drawn or computer-produced, Tufte warns, information graphics should not be used to “show the obvious to the ignorant”; instead, he urges us to see them as “instruments for reasoning about quantitative information.”⁵ Good infographics make sense of data through visual display, illuminating insights typically obscured in text and numbers. They transform raw data through statistics and design, making complex

ideas clear and precise. Charts like the *USA Today* Snapshots present information, but they fail to provide *instrumentation* or to inspire *reasoning*. *Budget Hero*, by contrast, offers a detailed context for budgetary information, as well as a set of challenges that inspire players to reason about that data.

Tufte studies the use of information graphics in any domain, but *Budget Hero* suggests that journalism offers a particularly salient domain for making sense of information. As designer Alberto Cairo explains, news infographics demand sound journalistic effort as much as they require competent information design.⁶ Infographics place data in context to assess cause and effect, to allow for quantitative comparisons, to present alternatives and contrary cases, and to assist in decision making.⁷ They are used to inform, to reveal details in information that would otherwise be obscured, and even to persuade readers to see new relationships between actors and systems in the world. The news infographic designer thus embraces the journalistic value of synthesis, condensing complicated information into a legible format.⁸

Tufte's and Cairo's ideas are hardly new. William Playfair, an infographics pioneer of the late eighteenth century, published tracts on economics and politics in an attempt to eke out a living as an independent journalist.⁹ Over the course of his career, Playfair pioneered the graphical forms that are now familiar parts of our mathematical education: line charts, bar graphs, and pie charts. The beautiful charts in Playfair's *Commercial and Political Atlas* inspired Charles Joseph Maynard, designer of the famous map of Napoleon's 1812 march into Russia.¹⁰ Maynard transformed a plotted course of Napoleon's path into a statistical map representing the dwindling size of his army, valuing data over geography. Edward Tufte claims that this map "may well be the best statistical graphic ever drawn."¹¹

Most early infographics were used in economics, mathematics, and the sciences, but it was not long before they found broader application. In the 1920s Otto Neurath, inspired by Swiss modernist design, espoused information graphics as a form of communication that could potentially rival the written word.¹² His *isotype* movement sought to create a universal language of symbols featuring abstracted shapes best compared to the human silhouettes on the doors of restrooms. The purpose of the movement was to find the most effective form of visual communication—a kind of "prose graphic."¹³

At the same time Neurath worked to popularize pictorial language, infographics began to appear in American newspapers. On the front page of its November 3, 1920 edition, the *New York Times* demonstrated the

results of the presidential race by mapping them onto an image of the United States in the familiar style of today's election returns maps.¹⁴ Rather than using an alphabetical list of states and their polling results, the map makes visual connections between geographic areas and their political alignment. According to the map, the America of the roaring twenties was split along an old geographic wound—the South voted for Cox while the rest of the nation voted for Harding. Simple maps like these were the most prevalent infographics until the influx of immigrants in the 1930s brought the European style of infographic design to the United States.

Thanks in part to Czech information designer Ladislav Sutnar's role in the 1939 New York World's Fair, continental graphic design took off in America by the outset of World War II.¹⁵ That year, *Fortune* magazine published a page of graphical bar charts based on a business survey it had conducted, using simple outlines of people to illustrate the survey's choices.¹⁶ While major publishers possessed both the resources and the technology to pursue infographics, the field remained untouched by smaller newspapers and publishing outlets.

As the war years gave way to the prosperous 1950s and 1960s, a more creative take on infographics unseated the isotype style. The New York School "chartoon" style, popularized by Nigel Holmes in the 1960s and 1970s, reacted against the overly functionalist graphics of the mid-century. Chartoons dress up displays of graphical data with cartoon-like illustrations and extraneous detail to make the graphics more visually appealing, a precursor to the high-gloss, low-synthesis graphics of the *USA Today*.¹⁷

A large supply of professional artists entering the rapidly expanding fields of print publishing and advertising further emphasized illustration over information.¹⁸ Edmund Arnold, considered by many the father of modern newspaper design, was among them. A graphic designer and journalist, Arnold incorporated images and infographics into the routine of the newsroom and into the more than one thousand newspapers he designed.¹⁹ In 1977, *Time* magazine underwent a redesign that included frequent pop-data graphics contributions from another news diagram innovator, Nigel Holmes. Even though he deployed a less technical style than Playfair had two centuries earlier, Holmes reinvigorated infographics as a legitimate branch of journalistic endeavor.²⁰ Between 1965 and 1980, the *New York Times* frequently published sophisticated infographics, becoming the main proponent of the form in newspapers for decades.²¹ But the infographics in the *Times* of this period, and the purposes they served, were altogether different from those the *USA Today* would popularize in the early 1980s by publishing them daily. The latter's need for daily

data forced the paper to turn to simple polls, trite little info-nibbles. It was part of a move that earned the *USA Today* the name "McPaper" for its focus on soft and inconsequential questions. Figure 3.2 shows examples from the evolution of journalistic infographics.

Despite their questionable value, the *USA Today's* daily graphics raised the bar on the form by changing expectations. The growing accessibility of desktop computers in the 1980s led to the faster production of more affordable graphics, but early software was still too primitive to be used quickly in newsrooms. By 1988 editors were clamoring for graphics, and news wire services entered the race.²² Moving from telephone lines to satellite delivery systems, the Associated Press, the Knight-Ridder-Tribune News Service, the New York Times News Service, and the Gannett News Service began offering graphics just as they offered news stories by wire. Infographics not only improved readers' comprehension of information, they also sold papers, adding visual flare to an otherwise text-heavy medium.

The journalistic yang to *USA Today's* yin would emerge in the digital age. The *South Florida Sun-Sentinel* brought on Don Wittekind in 1996 to head their interactive graphics department. Wittekind expanded the department to create infographics to complement stories from the print and online news departments. Another early adopter of digital infographics, the online edition of Spain's second largest newspaper *El Mundo* (*elmundo.es*) founded its online graphics department in 1999. Alberto Cairo, a founder of the department, has written extensively on the transition from print to digital infographics, with a focus on journalistic integrity over novelty of implementation.²³

Uses of Digital Infographics

In print, infographics are static by necessity. *Digital infographics*, by contrast, involve computation and user manipulation of underlying information. At its simplest, a digital infographic might layer ancillary information visually, such that additional detail is revealed when a user moves the mouse pointer over a particular object. But genuine digital infographics make interaction a part of understanding: analog infographics are *read*, whereas digital infographics are *operated*. Maish Nichani and Venkat Rajamanickam coin the term *interactives* to underscore the difference—explanation through interaction.²⁴

According to Nichani and Rajamanickam, the interactive has the potential to free information from the rigid constraints of the printed word. They offer four categories of interactive graphics: *narrative*, *instructive*, *explorative*,

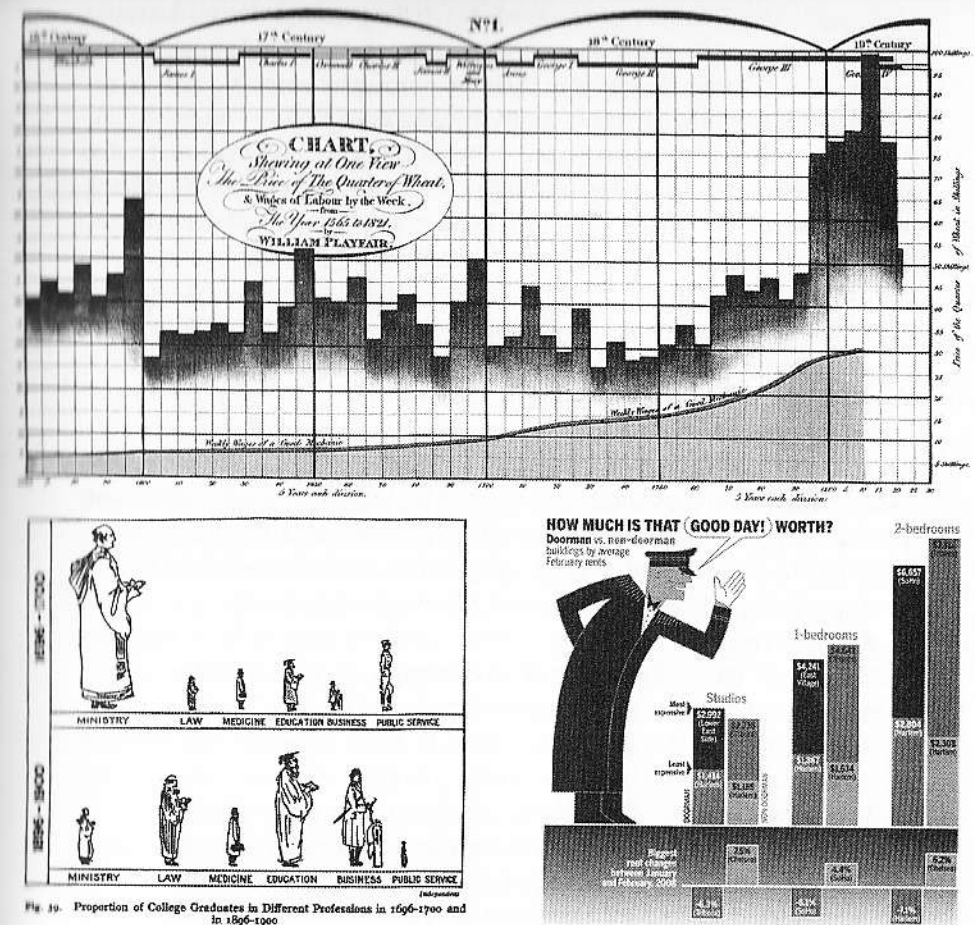


Figure 3.2

The changing aesthetic of infographics as depicted in a series of bar graphs. Plotted data are transformed by illustrations to provide additional information while making the graphic more appealing. Top: William Playfair, *Commercial and Political Atlas* (1786); bottom left: Willard C. Brinton, *Graphic Methods for Presenting Facts* (1914); bottom right: Nigel Holmes, *New York Observer* (2008).

and *simulative*. Narratives are used for telling straightforward stories, instructives provide step-by-step directions to reach a single goal, exploratives allow the user to engage in their own processes of sense-making, and simulatives allow the reader to grasp the processes of a system.²⁵

By becoming active participants in the unfolding of information, readers can develop a deeper understanding of the underlying logic of an issue. *Budget Hero* offers an object lesson: instead of depicting trivial details about the budget as would a *USA Today* snapshot or even a static bar graph, *Budget Hero* allows players to *experience* the difficult trade-offs required to promote particular social programs. Nichani and Rajamanickam's categories may offer useful ways to group examples or guide production, but we prefer to focus on the possible uses of infographics.

We propose three primary patterns of use for infographics, both digital and nondigital. *Explanatory* infographics depict specific data for simultaneous consumption. *Exploratory* (or free-form) infographics allow participants to draw a variety of conclusions by manipulating data according to personal goals or ideas. And *directed* infographics guide readers through data in a specific way, leading to a shared experience of synthesis.

Explanatory graphics display synthesized information in a relatively static form. They value results over processes, abstracting discussions about how a journalist arrived at a particular conclusion. Such information might be quantitative, qualitative, or narrative in form. Consider the *New York Times* front-page graphic from December 16, 1965, which shows a diagram of the *Gemini 6* and *7* flight crews' rendezvous while orbiting Earth.²⁶ It illustrates the orbital paths of the two ships, and comment boxes attached to points on the paths describe key steps in the process. A single reading of all the details offers sufficient explanation.

Portfolio.com's May 2009 feature on the construction of the Boeing 787 Dreamliner aircraft offers a digital example of an explanatory infographic. An exploded view of the 787 makes its constituent parts easier to identify.²⁷ Lines direct the eye to these elements, and hovering over dots on the graphic reveals information about where a particular part is manufactured. The purpose of the graphic is to illustrate the global production of the aircraft, a business decision that had been required to accomplish Boeing's engineering goals, but which had also introduced unexpected logistical delays.

Exploratory (free-form) graphics show data that is meant to be synthesized by the user independently of the creator's expectations. Both Tufte and Benjamin Schneiderman encourage the use of information graphics to offer multiple levels of granularity for maximum flexibility. Tools or

controls allow the reader to arrange, filter, or zoom data. For example, a map of the world produced by Dan Smith in *The State of the World Atlas* represents a country's size not by its geographic mass but by its population.²⁸ A few textual notes detail general trends in population growth, but it is up to readers to discover how the maps might clarify their particular situations. The graphic features a high density of information presented in multiple formats that encourage the reader to explore, make comparisons using the different graphics, and draw conclusions about the world's population.

USA Today's 2008 "Presidential Primary Delegate Tracker" graphic offers a commendable example of an exploratory digital infographic.²⁹ The graphic depicts a map of the United States, timelines of Democrat and Republican events, and a bar graph with the total number of delegate votes cast for each presidential candidate. Rolling over states on the map shows how many votes each delegate won. Mousing over points on the timeline highlights the states whose primaries approached, while also masking previously decided states. As users approach the map by means of these different tools, they develop a better sense of the unfolding drama of the primary.

Directed infographics guide the reader through a dynamic data set toward a conclusion synthesized beforehand by the designer or journalist. Spatial, temporal, or process-heavy stories often lend themselves to directed graphical rendition. The front page of the January 26, 1986, *USA Today* features a large color graphic explaining the tragic explosion of the Space Shuttle *Challenger*.³⁰ An explanation of liftoff appears, with increments of time detailing the one minute and fifty-one seconds before the shuttle exploded. It uses an insert map of the Cape Canaveral area to situate the event, and two cut-away diagrams of the shuttle—one of the rockets and one of the shuttle's cockpit—to add detail. Directed activity encourages constrained exploration. The *Challenger* infographic guides the reader through the chronology of the tragedy, while providing supplementary information that might offer detail and context.

In digital infographics, direction can prompt the user to explore abstract or generic information from the perspective of his or her personal situation. Imagine a hypothetical family that lives in East Orange, New Jersey. A wife, husband, and their one child have been renting a house, but the wife has been offered an opportunity to be transferred to her engineering firm's new branch in Reston, Virginia. Her husband is self-employed, so he has the freedom to work from anywhere. When they first moved to East Orange they assumed they wouldn't be able to afford a house, but a few

years of savings plus the raise she would receive upon transferring have turned their attention to the possibility of home ownership. Does it make financial sense to try to buy a home in Virginia? They would rather not see a financial planner without first exploring some options, so they search the Web for information. There are thousands of generic mortgage calculators online, but they stumble on a more robust tool: the *New York Times* rent-buy calculator, "Is It Better to Buy or Rent?"³¹

The calculator is an interactive infographic that compares the relative costs of renting and buying equivalent homes. The graphic contains fields to enter rent cost, home price, down payment, mortgage rate, and annual property taxes. Additionally, it uses two sliders to adjust annual changes in home value and rent. As shown in figure 3.3, a timeline at the center shows how many years it would take to justify the cost of buying a home, paying property taxes, and settling a mortgage versus simply renting. The calculator even accounts for more specific costs: condo or home-owners association fees, costs of selling a home, maintenance costs, rent deposit, rate of return on investment if the money used to buy a home were invested elsewhere, and so on. Though the results of the calculator shouldn't be taken as gospel, they offer a concrete starting point for people looking for homes in an uncertain housing market. The tool directs use by prompting the user to enter personalized information.

Information graphics find a close relative in the world of computing: *information visualization* or *infovis*. While both fields concern the visual representation of data, information visualization values computational innovation first, elucidation second.³² It is used to for "exploiting the dynamic, interactive, inexpensive medium of graphical computers to devise new external aids enhancing cognitive abilities."³³ Whereas information graphics generally entail hand-drawn materials produced by an artist, infovis artifacts use computers both for processing large quantities of data and for rendering that data. In a data set with thousands or millions of individual elements, a computer's speed, power, and accuracy are required to produce a viable rendering. As such, infovis has traditionally taken place among computer professionals—experts with experience analyzing problems in a specific domain, and with the know-how to write software to render the results of that analysis.

By and large, infovis has found root in highly technical contexts, where scientific information is both large and complex. However, Zachary Pousman, John Stasko, and Michael Mateas have coined the term "casual infovis" to suggest a broader role for information visualization in less professional contexts.³⁴ Examples abound, aggregated from the corners of the

UPDATED JUNE 2, 2003

Is It Better to Buy or Rent?

Compare the costs of renting and buying equivalent homes. Click CALCULATE after you make changes.

E-MAIL | FEEDBACK

Methodology | Related article

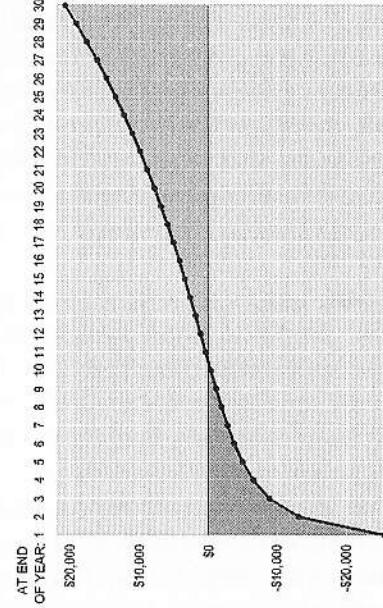
ADVANCED SETTINGS			
Renting		Buying	
Monthly rent: \$	1300	Home price: \$	240900
Down payment: \$	36135	Mortgage rate: (\$1,241/month)	6.1%
Annual property taxes: \$	3493	Annual property taxes: \$	3493
15%		1.45%	
<input type="button" value="CALCULATE"/>		<input type="button" value="CALCULATE"/>	

Buying is better than renting after 10 years if:

Annual home price appreciation is: **+1%**

Annual rent increase/decrease is: **+5%**

Move the sliders to see how changes in rent and home prices affect the outcome.



The chart shows the average annual savings at the end of each year of owning or renting.

Buying is better
Renting is better

Click on a data point to see a summary of costs for that year.

SUMMARY OF BUYING	
Initial costs	-
Operating costs	-
Balance of sale	-
Total buying costs after -- years	-
SUMMARY OF RENTING	
Initial costs	-
Operating costs	-
Return of deposit	-
Total renting costs after -- years	-

Figure 3.3

Not only does the Web application "Is It Better to Buy or Rent?" let users enter a large range of data to produce a graph that determines the year a person is better off buying a home than renting, it also demonstrates the importance of exploring data through manipulable sliders and input. In this example, a user can see how increased rental rates might influence buying decisions.

Web on sites like FlowingData.com. Their “5 Best Data Visualization Projects of the Year” for 2008 features a static infographic, dynamic infovis, and even two video projects.³⁵

The wider availability of both graphic design software and software development tools has drawn the practices of both infographics and information visualization into increasing overlap, despite their differences. On the one hand, infographics deploy the artist/journalist as an information synthesizer. The author of the graphic provides direction and prompts specific user engagement. Infovis, on the other hand, makes use of large data sets that can reveal underlying patterns that might be difficult to identify without visual arrangement. But because infographics have a long tradition in journalism, we have chosen to use the term inclusively, to encompass both traditional applications of infographics as well as the increasingly complex information-processing techniques of information visualization.

Playing with Infographics

The history of journalistic infographics highlights not only their on-again, off-again relationship with intricacy over simplicity, but also the changing attitudes toward their purpose and execution. Infographics started as a tool for economists, sociologists, and scientists—serious data depicted seriously. The rigidity of the form loosened as designers sought to make visual presentation more compelling for popular audiences—the silhouetted outline of an iconic woman from a pictographic language transformed into a style of popular cartoons and comics. Today, infographics range from graphically formal to stylized, rational to emotional, serious to inconsequential. Their power for visual appeal and explanation is well acknowledged in journalism, but infographics still have not fully exploited computation as a medium for *behavior* as well as visualization.

Videogames offer a new model for infographics, one that might combine the analytical sophistication of Playfair’s and Maynard’s early infographics with the emotional context of later approaches. Digital infographics intersect with the world of games when we can *play* with them.

Play has been defined in many ways. Anthropologist Johan Huizinga called it a “free activity” standing “outside ‘ordinary’ life,” one that is “not serious” but at the same time absorbs the player intensely and utterly.³⁶ Roger Caillois refined Huizinga’s definition: play is “free, separate, uncertain, unproductive, governed by rules, and make-believe.”³⁷ But game designers Katie Salen and Eric Zimmerman offer the best general definition

of play: “free movement within a more rigid structure.”³⁸ Even if they are not games quite like *Pac-Man* or *The Sims*, infographics can become *game-like*, exploiting the properties of games in numerous ways: to encourage the manipulation of information for replayability, to allow pleasurable engagement with a system, or to invite exploration.

We might call them *playable infographics*: works that adopt infographics’ principles but add layers of gameplay around them. In particular, playable infographics embrace a synthetic amalgam of directed and exploratory infographic design principles. Consider *Budget Hero* once more. The game offers a directed experience, in which the player must create a budget that extends as far into the future as possible without going bust, while maintaining a reasonable debt ratio and accomplishing personal political goals. Players cannot simply move budget sliders around willy-nilly, as if budgetary commitments existed only on an annual basis. Nor can they make allocations without the appropriate tax receipts or debt obligations to support them.

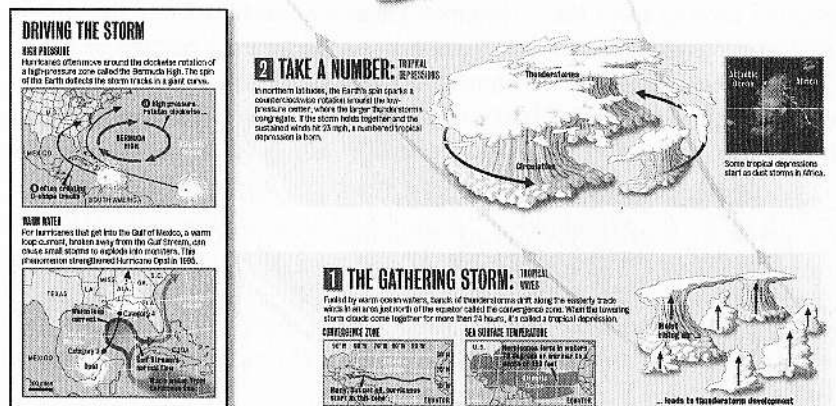
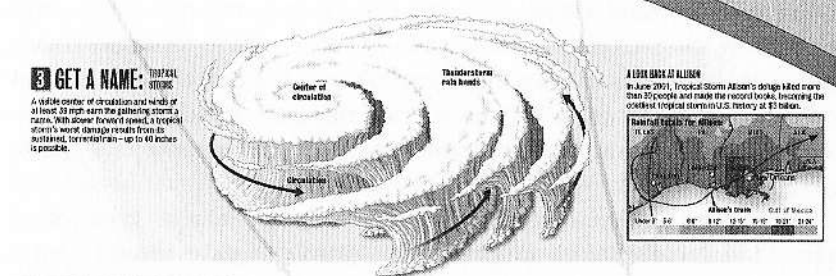
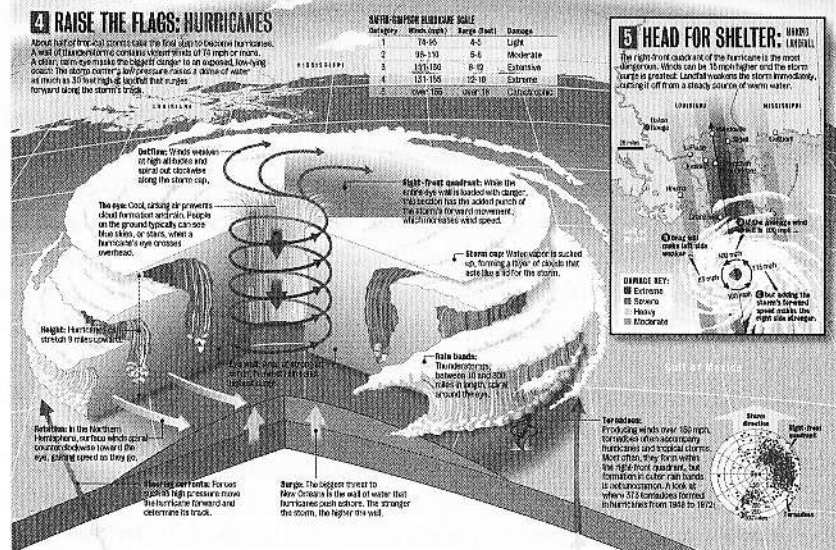
At the same time, *Budget Hero* offers an exploratory experience. Unlike explanatory infographics, which offer no choice whatsoever, and unlike narrative games, which offer a progression through a set of challenges that tell a story, *Budget Hero* won’t do anything without player intervention. The player can make a range of choices: exploring the requirements of different budget-goal badges, browsing the policy and taxation cards, and researching the pros, cons, and impact of public policies associated with those cards. The player can pursue some, all, or none of these options at any time. The best playable infographics offer specific direction in the context of broader information exploration, using the space of experimentation as the “free movement” that produces play.

Budget Hero is instructive, but it offers only one example. What other types of playable graphics are possible? In print or online, common infographics formats from the newspaper, television, and the Web take different forms for different functions. Eric K. Meyer summarized these forms in his guide to designing infographics. We have modified them slightly to better apply to interactive digital infographics (see figure 3.4 for the forms in practice).

Graphs compare quantities of information in familiar formats: bar graph, line graph, a pie chart, fever chart, or in more complex combinations. *Sequential graphics*, which take the form of *chronological* and *process graphics*, allow the order of the data to take a central place in unfolding information.

NATURE'S ULTIMATE WEAPON

Whether they're called hurricanes, typhoons or cyclones, they are the most devastating weather events — churning masses of wind and rain that cause swaths of damage up to hundreds of miles wide at points along paths a thousand miles long. Beginning as thunderstorms in equatorial seas, the biggest storms can release as much energy as 15 atomic bombs and send walls of water 30 feet high surging into unprotected coastlines.



Maps display geographically situated data rather than physical geography itself. A map might conform to traditional depictions of spatial arrangement, or it might distort the area for aesthetic or informatic effect.

Diagrams present a piece of information in order to explain its individual components. A diagram presents an object, concept, event, or scene, and describes the illustration with labels, comment boxes, iconography, and other explanatory figures. Renderings, exaggerations, exploded views, and cutaways are examples of diagrams.³⁹

These formats are not mutually exclusive. Bar graphs can appear on a timeline, process graphics can show geographically situated steps, and a diagram can depict a dynamic process. Furthermore, different formats can explain a subject in different ways. Consider a volcanic eruption. A bar graph might compare the amount of ash thrown into the atmosphere to other eruptions in the past. A volcano's geological birth might form the basis of a process graphic. A temporal graphic might situate the events just after the eruption, such as the dispersal of ash and the movement of the surrounding population in response to it. A map might illustrate the path of a molten lava river, while a diagram might show a cutaway of the volcano's interior and its various geological components.

Playable infographics derive from these common types of traditional or digital infographics, adapting their forms, features, and benefits for use in directed exploration.

Playing with Graphs

When Laura Wattenberg published a book on baby names, her husband Martin, an infovis designer at IBM Research, created a visualization tool called NameVoyager to support its release.⁴⁰ Powered by lists of the thousand most popular names for boys and girls from every decade from 1900 to present, NameVoyager graphs complete or partial names on a timeline of popularity, instantly updating its view as the user types (see figure 3.5).

◀ Figure 3.4

This full-page spread on the development of a hurricane incorporates different infographic forms to tell its story. As indicated by the bold numbers, “Nature’s Ultimate Weapon” is a sequential graphic detailing the order of events as a hurricane forms and makes landfall. Diagrams illustrate the motion of the air as the clouds gather, maps track the motion of the storm and locate rainfall data geographically, and a circular scatterplot reveals the frequency of tornadoes found in the different locations of the swirling storm. Image courtesy of Dan Swenson/The Times-Picayune.

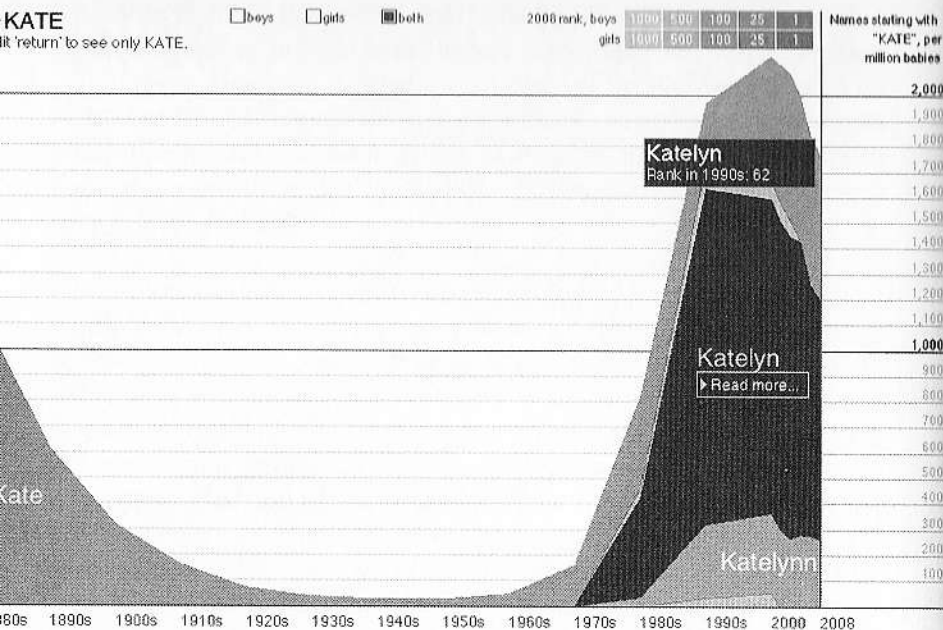


Figure 3.5

Martin Wattenberg's NameVoyager illustrates the decline and rise in popularity of given names. Here we see the ebbs and flows in adoption of the name Kate as well as the meteoric rise of the name Katelyn in the 1970s.

Though NameVoyager is clearly not intended to be a game, as more people used it, Wattenberg noticed that they talked about exploring the data playfully, "identifying trends and anomalies and forming conjectures."⁴¹ For example, one Web site commenter suggested: "For a challenge, try finding a name that was popular at the beginning of the sample, went out of style, then came back into vogue recently." Wattenberg calls the tool's usage patterns "strongly social" and "more closely related to those of online multiplayer games than to a conventional single-user statistical tool."⁴²

Wattenberg noticed trends in user activity that he aligned with Richard Bartle's four categories of players in online games—explorers, achievers, socializers, and killers.⁴³ Such an idea disrupts the traditional view of information visualization as a task-oriented, problem-solving activity. NameVoyager is playable because its users have invented directed goals within the exploratory context of the visualization. The achievers in NameVoyager used the tool for its primary function: to pick out a name

for their baby. "We want something slightly retro, nice, and not too popular," one woman wrote, "and this visualization gives us all that." NameVoyager socializers are users "whose main concern is their interactions with others, and who place their data exploration in a personal social context," often searching for their own name or friends and family names and commenting on the results in context of their experiences. Some of the explorers particularly enjoy discovering odd names or unusual groups of names. Finally, the "killers" (aggressive, acerbic players) take pleasure in mocking the names they find, seeking out targets to ridicule. As one killer comments, "Britney, Brittney, Britany, Brittany, Brittani, Britannie, Britni. Enough already."

These behaviors do not quite make the visualization a game, particularly since NameVoyager's "players" have to invent their own goals. But they do suggest that playful, gamelike habits developed around the work. It is not hard to imagine an even more playable implementation of NameVoyager: the graph could be treated as a puzzle, and an author could set specific goals: find a name popular in the 1920s that returned in the 1990s, or find a name equally popular for boys and girls in the 1970s. While the freedom of open exploration might seem preferable, a guided experience would help retain users who might not know where to begin when confronted with an unstructured visualization.

Playing with Sequential Graphics

A vivid example of a *chronological* graphic comes from a news story that rapidly unfolds over a matter of minutes. Built atop the popular flight-simulator *X-Plane*, *Sully's Flight* is an iPhone game that puts the player in the cockpit of US Airways Flight 1549, piloted by Chesley Sullenberger, which was forced to land in the Hudson River on January 15, 2009. The player begins on LaGuardia Airport runway four in the cockpit of an Airbus A320. The path of the flight is outlined on the screen by green reticles, through which the player must pilot the aircraft. The screen animates with objects hitting the windshield at the proper moment the geese were said to have struck the airplane. The engines lose thrust and it is up to the player to make a successful river landing.

Sully's flight was widely covered, but mostly from the vantage point of heroism in general. Understanding the quickly unfolding events of the emergency itself offers a different perspective. The re-creation of the plane's flight path helps, but the game's reproduction of cockpit radio transmissions between US1549 and air traffic control best accentuates the flight's urgency. The live audio is far more effective than a static infographic with

a timeline of events or a written transcript. Even with perfect hindsight, successfully making a landing proves challenging, offering a powerful illustration of the improbable accomplishments of Captain Sullenberger.

In other circumstances, chronology is less critical than *process*. Consider the unpredictable dangers of hurricanes to Florida coastal residents. The events of a past disaster might be instructive, but less so than the process by which hurricanes develop and move. What better way to understand such a storm than to make your own? The *South Florida Sun Sentinel's* Web site offers just such a tool, a "Hurricane Maker."⁴⁴ It presents the user with a map of the Atlantic and coastal regions of the Americas. It then invites the user to place a storm on the map, choosing a body of water with a higher average temperature to ensure the hurricane will form. Wind shear can be set at different altitudes, and humidity levels around the storm can be tweaked. Once the player is satisfied, a button press sets the hurricane in motion. If all the proper conditions have been met, the little storm animates into a fearsome hurricane. If not, the infographic explains reasons for the user's failure and offers a chance to try again. Hurricane Maker has playful qualities: players attempt to achieve a goal by adjusting a system. It teaches users through trial and error, by directing their interaction. Still, even if it might satisfy intellectual curiosity, Hurricane Maker disappoints as an overall experience. Its hurricane never moves nor makes landfall, abstracting the average reader's concern about safety and property into an unsatisfying binary of success or failure.

"The Earth Impact Effects Program" (EIEP) offers a better example of a procedural infographic, albeit for a less likely catastrophe.⁴⁵ Developed by researchers at the University of Arizona's Lunar and Planetary Laboratory, EIEP is a text-only Web page that allows its users to tweak the parameters of an inbound doomsday asteroid to estimate "the regional environmental consequences of an impact on Earth."⁴⁶ Like Hurricane Maker, EIEP plays on our fascination with disasters, daring users to orchestrate the greatest destruction possible. Hurricane Maker makes an all-or-nothing gambit: players either create a hurricane or not. EIEP, by contrast, encourages players to trigger all its various scenarios of destruction, from seismic effects to thermal radiation.

In gaming terms, EIEP is more replayable. While game makers prize the trait as a virtue of good game design, replayability isn't necessarily a journalistic value unless it encourages broader and deeper understanding.⁴⁷ EIEP describes the results of the user's input in far greater detail—the size of the crater, seismic activity, scattered debris, and global climate change. It lists the relevant parameters of several famous asteroids to give players

a sense of scale, to provide context, and to guide subsequent choices. By playing with it multiple times, one develops a sense of the plausible outcomes of an asteroid cataclysm. In that respect, EIEP's merit as news might seem suspect (until an asteroid actually threatens the Earth). Yet it shows the untapped potential of playable infographics like Hurricane Maker.

Playing with Maps

The ReDistricting Game challenges players to redraw fictional Congressional districts along party lines. Red and blue dots of varying density show concentrations of partisan populations, and colors on the map itself indicate elected officials' current districts. The player must recolor the map such that each official is satisfied with his or her district, districts are of proportional sizes, and a chosen party enjoys election victory. *The ReDistricting Game* focuses on geographic data manipulation as a political strategy, providing directed gerrymandering goals along with an exploratory map.

While *The ReDistricting Game* characterizes a process, the *New York Times'* Hurricane Gustav interactive map and the Minnesota Bridge Collapse map offer event reporting via geographical infographic.⁴⁸ Released soon after the tragedies, these maps allow people affected by these events to attach text and multimedia to nodes on a map of the area. The Hurricane Gustav map is simple: it's just a Google Map covering some the states impacted by the hurricane. Users can click on points on the map that link to video, audio, or photos of the disaster. The Minnesota Bridge Collapse map is far more sensational. From a helicopter or satellite's point of view, we look down from the sky at the destroyed bridge. Nodes appear for survivors and victims. Family members can leave messages of grace or sorrow, adding humanity to the traditional list of names and statistics.

While the Minnesota Bridge Collapse memorializes a current event, the Pittsburgh Bike Map aggregates the experiences of user contributions to paint a landscape of the issues of biking in a major city.⁴⁹ This map offers a hub for bikers in Pittsburgh to learn about current biking conditions in the city. Different types of information—including nodes for bike shops, trails, and accidents—can be turned on and off. One can zoom in or out to get a better sense of the area. Of particular note are the map's crash reports. Unlike a crime map that reports violations without detail—"burglary, grand theft auto, larceny"—the bike map's reports are fleshed out so others can understand the extent of the problem.

Playable maps like these are not intended to be experienced in a particular order, nor does the user have to engage with all possible data. The

user identifies with stories the map traces, constructing relevant meaning from fragments. Story maps like Minnesota Bridge Collapse aren't games in the traditional sense, but their format encourages exploration and narrative construction. The Pittsburgh Bike Map inspires an unusual kind of play, one that takes place both on and off the computer (a topic addressed in detail in chapter 7). Users consult the map to optimize their strategy outdoors in the city. After testing routes and forging new paths, they return to update information and tactics for the benefit of other users.

Playing with Diagrams

The *Sun Sentinel's* Virtual Butterfly Ballot works like an interactive diagram. Re-creating the experience of the confused Palm Beach County voter during the controversial 2000 U.S. presidential election, the interactive graphic reproduces the ballot used in that county and challenges the user to cast a vote correctly for a specified candidate.⁵⁰ If the intended and actual candidates do not match, a message explains possible reasons, clarifying how perceptual conundrums might have caused real voters to make unintended choices: ballot punch holes don't line up well with names and arrows (see figure 3.6). A voter reading top to bottom on the left side easily

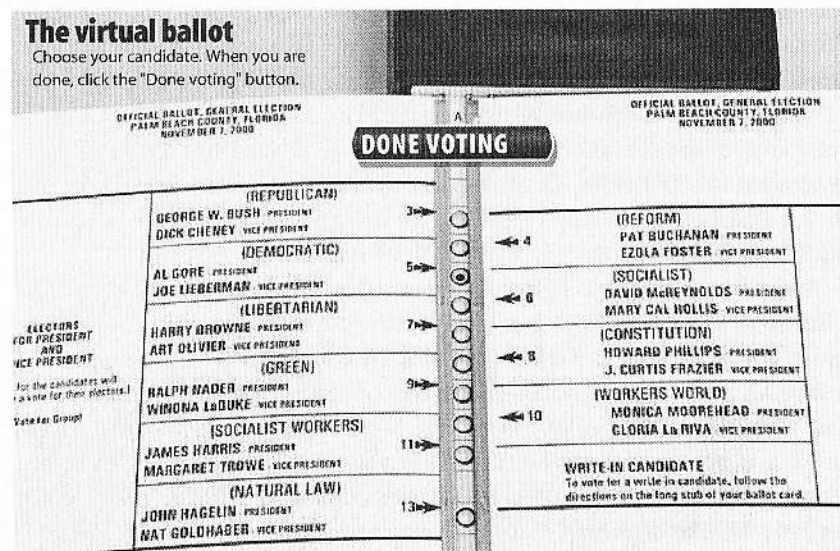


Figure 3.6

A quick glance at the *South Florida Sun Sentinel's* Butterfly Ballot infographic clarifies why Florida voters might have cast votes for different candidates than they intended.

might have intended to mark the third hole to vote for Al Gore, but inadvertently selected the second, voting for Pat Buchanan instead.

Though not grounded in fact or journalistic intention, *Effing Hail* by Jiggman and Greg Wohlwend of Intuition Games is a Web game that looks like an infographic.⁵¹ It is an isometrically positioned diagram of the atmosphere sliced into fictionally named sections (the cleverly invented Aiesphere through Effingsphere). The player's mouse-clicks create strong updrafts of wind that can lift falling precipitation into the upper atmosphere to form large hailstones, which then pound the defenseless buildings on the ground. The game asks players to craft armies of hail, pummeling an increasingly stronger set of buildings and objects in the sky within a time limit.

Though the game is not intended to teach users about the meteorological phenomenon, it (imprecisely) uses the process that builds hail in the atmosphere as a physics mechanic and indirectly (and again imprecisely) educates the player about such conditions. This educational facade arises largely from the game's infographic aesthetics. It is not only the type of design one might find in a popular magazine or Earth studies textbook, but also what we might see in a newspaper article about a recent storm.

Synthesis in Playable Data

Bill Kovach and Tom Rosenstiel have argued that fast access to detailed information, particularly information gathered online, has made it too easy to ignore the foundation of a news story.⁵² The lurid dissonance of comments, blog posts, tweets, and other speculation can occlude the important elements of a topic. Infographics offer a possible reprieve from the anonymity of information, particularly when the exploratory and directed uses of the form are combined.

At first blush, journalists might think exploratory infographics like "Is It Better to Buy or Rent?" work best when they are unfettered, when users can do whatever they want with them. They certainly seem more flexible that way, too: an individual can configure the infographic for any purpose whatsoever. But total freedom is not always illuminating. It can fail to point out the particular examples of a system, such as home ownership, that might offer punctuations of clarity.

For example, what if the Rent-Buy Calculator offered optional but explicit goals, like the ones Wattenberg catalogs from NameVoyager adopters? "Find a city with a population larger than 500,000 where buying a \$250,000 home won't pay off in five years," or "Find the town in Idaho

where home ownership is the most effective for families with a monthly housing budget of \$1,200." By acting more like a game, the infographic could provide insights into the situations of particular citizens, while still allowing users to apply it to their own situations.

When authorial direction guides exploratory activities, the author can "sift out the rumor, the innuendo, the insignificant, and the spin," while focusing effort on what makes the story important and relevant.⁵³ The journalist's role is to make sense of facts, but without author synthesis the data remain raw and undigestible. Though an interesting visualization may be visually appealing, forcing the user to do all the work putting it together results in research, not journalism.

Another *New York Times* infographic, "How Different Groups Spend Their Day," offers an interactive graph of daily activities performed by eighteen demographic groups in twenty categories of daily activities, chronicling them over the day in ten-minute intervals.⁵⁴ It has enjoyed the sort of "viral" response on blogs and Twitter that many publishers and citizens mistake for journalistic impact. Among those who commented on the link, game designer Raph Koster wrote that "it invites exploration; it feels fun to investigate."⁵⁵ Others underscored the "fascinating" results that emerge from the large quantities of information in the data set.⁵⁶ Yet, the graphic itself does little more than compile a lot of data in one place, wrapped in a clever interface (figure 3.7).

Why, then, do people like it so much? Each reader has some stake in the data presented by the visualization. Although its use is not directed by instructions, the graphic's categories suggest goals—everyone fits into at least some part of the demographic survey. An employed white male aged 25–64, with an advanced degree and zero children, has five initial categories to start exploring. He might then branch out to other demographic groups, perhaps those of friends and family, to compare results. Users can drag a mouse over the graph for more detailed information, or click on areas of the chart to isolate them for examination. Perhaps that is what people are attracted to: the sheer amount of seemingly precise data.

In the end, it is difficult to say what a reader is supposed to take away from the visualization. Does it reveal something important? Will the average reader even remember what he or she saw in the graphic? Ought it to be used for scheduling? For self-improvement? For mockery? The *New York Times* puts all the data in one place, yet fails to synthesize its meaning. The accompanying article says little about the results of the survey, and the textual information displayed while browsing the graph amounts to little more than "fun facts," which may or may not be related to the data

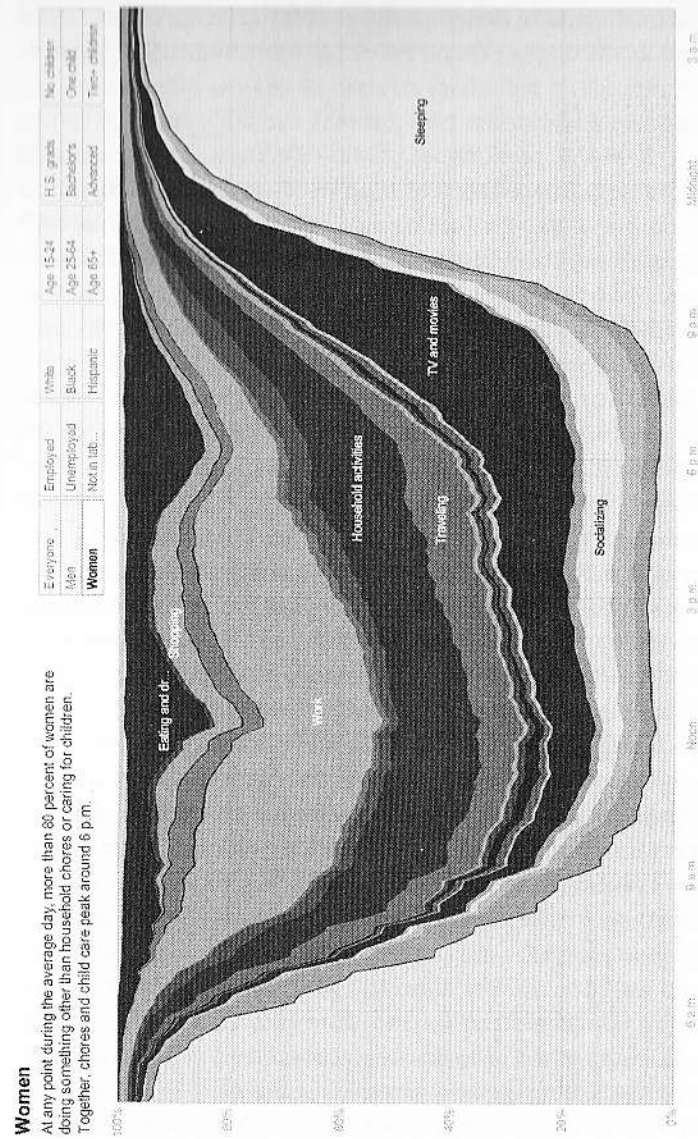


Figure 3.7

A wealth of data lies below the surface of the *New York Times* "How Different Groups Spend Their Day" infographic, but extracting relevant information is an arduous task. In addition to providing the tool, journalists must synthesize data meaningfully.

being examined.⁵⁷ The article describes the results of the survey as “striking,” yet there is no effort to expand on what counts as striking in this context.

An experiment on CNN shows how context can add synthesis to raw data. During the 2008 U.S. presidential primary elections, CNN premiered its “Magic Wall,” a large interactive screen on which current and historical electoral information, mostly in the form of maps, could be displayed.⁵⁸ Like Apple’s iPhone and iPad, the screen offers multitouch capability for fluid, tactile operation. Instead of leaping from one bit of data to another by clicking a hyperlink, the user transforms the screen’s image by direct application of several fingers.

Because elections are complex, media outlets have tried to help citizens understand the electoral process using graphical representations of the electoral data—most frequently in the form of maps and charts. CNN deployed the Magic Wall for just this purpose, to better explain the dynamics of election data using a technology that allowed for fluid transitions between different levels of information.⁵⁹ During the 2008 primary, CNN National Correspondent John King seemed more interested in the novelty of the system than its potential as a reporting tool. He played with the multitouch features like a child with a new toy on Christmas morning, moving the map around to show off the technology rather than to use it for information. Criticisms, including a *Saturday Night Live* send-up, may have inspired the network to reconsider their use of the map.⁶⁰

By election day, King had moved past the device’s novelty and began to use the screen for information analysis. As polling returns flowed in over the course of the evening, King used the screen to show regions—including individual counties—with the potential to influence the election’s outcome. Calling up data from previous elections, King compared historical results with projections and polls to form hypotheses on the magical screen. In a climactic moment, King used the map to show viewers why Republican candidate John McCain could not win the election based on returns alone, rather than projections. King used the screen as a data simulator but treated it as a puzzle, in which he played with states that the Republican candidate might earn in order to reach the needed 270 electoral votes. The presenter even gave states to McCain that were predicted to be won by the Democrats as a way to show that in the unlikely event the candidate might win those states, McCain still could not emerge victorious.

This simulation made the outcome of the 2008 presidential election visually clear, but it also showed how technology can be used to clarify the meaning of data, not just as newfangled gimmickry. The screen helped

King discover and explain the unseen details of the process while unveiling patterns that would be invisible on a static map. This multitouch interactive infographic worked because it facilitated the journalist’s process of performing this synthesis through dynamic contextual material on a live broadcast.

The frequent absence of synthesis draws attention to a quandary in contemporary information journalism. In recent years, technology advocates have called for “open data”—systems or services that publish the data they use, giving anyone the ability to download, evaluate, modify, and reuse the information as they please.⁶¹ In October 2008, the *New York Times* launched its Visualization Lab, which “allows readers to create compelling interactive charts, graphs, maps and other types of graphical presentations from data made available by *Times* editors.”⁶² Built atop IBM Research’s Many Eyes platform, readers of the *Times* can download data, create their own visualizations, and share them on the Web. The *Times* proclaims that “users could bring their insight to the process of interpreting data and information and discovering new and innovative ways of presenting them. Just as readers’ comments on articles and blogs enhance our journalism, these visualizations—and the sparks they generate—can take on new value in a social setting and become a catalyst for discussion.”⁶³

It sounds great in theory. But in practice, the output of these visualizations is less insightful: tag clouds of frequently used words in the Democratic and Republican national convention speeches, basic line graphs of infant mortality rates, and word trees of political party affiliation by religious tradition fill the pages of the Visualization Lab’s community Web site.⁶⁴ Few visualizations have been rated by members, and even fewer have elicited comments. Users have the option to look at visualizations made by the community or visualizations from the editors of the *New York Times*, but the content of both sections looks identical. With a limited number of data sets available and the finite number of Many Eyes output formats, the “democratic” open data appears to offer little more than good publicity. The mere availability of data is not enough to qualify as good journalism.

To be fair, the *Times*’ visualization system is limited; users can match one of twenty data sets to an output graph. They cannot manipulate the data outside the template, nor can they introduce new data to the existing data for comparison or correction. But even open data without such limitations often suffers the same synthetic failing. Creators of playable infographics should take care to heed the advice of Edward Tufte, who warns against needless, misleading, and deceptive graphics.⁶⁵ Thanks to the rising

popularity of infographics online, Web sites like Flowing Data and the aptly named Chartporn.org spread visualizations as entertainment. A “cool” visualization with a strong graphic design will just as readily spread as one that illuminates something fascinating and important about the data.

Playable infographics won’t solve the problems of data synthesis, but they can contribute to a solution. By addressing a set of information as a context for specific types of actions and goals in the context of broader exploration, data can gain both context and relevance. Infographic games like *Budget Hero* offer both freedom and perspective. It is not only the source of the data that is important, but also why the output format was chosen, what tools were used to produce it, how they might affect the outcome, and what service the resulting artifact claims to provide for citizens.

We might conclude that infographic games help players distinguish data from information. Data describe raw sensor readings, direct observations, and collected metrics. Information adds context and interpretation to the data, imbuing them with meaning. Creating an infographic is no longer just a matter of making data visual. Instead, it involves the creation of a tool to help understand that visual data by synthesizing it through play.

4 Documentary

Peering through the scope of a rifle, you focus on a turn in the road. You look up from the scope and out the window to the street six floors below. A vehicle turns the corner, moving toward you. The window of opportunity is small, so you must act more quickly than in most videogames. Police motorcycles pass by, followed by a few cars, and then you see your target: John Fitzgerald Kennedy. After you’ve squeezed the trigger a few times, the heart-thumping authenticity of the situation turns to cold statistics: a breakdown of the projectile ballistics of your shots, where each bullet struck, and what damage it caused (figure 4.1). You’ve just attempted to recreate Lee Harvey Oswald’s assassination of the president on November 22, 1963. The game is called *JFK Reloaded*, and its creators offered a reward of up to \$100,000 to the player who most closely matched the ballistic data in the Warren Commission reports.¹ Traffic Games hoped to put to rest the many conspiracy theories about JFK’s murder by inviting thousands of players to accurately re-create the single gunman account of the assassination.

Five years later, at the 2009 Games for Change Festival in New York City, University of Southern California professor Tracy Fullerton announced her plans to re-create Thoreau’s *Walden* as a game. A year into the design process, Fullerton described her intention to translate events from Thoreau’s story into plot points within the game, while crafting game mechanics that would force players to live by the rules of his personal experiment. She hopes to avoid reward-based gameplay or “simulated material gain,” which would be antithetical to Thoreau’s goals when he went to live away from society.² The structure provided by the historical events and mechanics might re-create and interrogate Thoreau’s philosophy of simple living.

On the surface, *Walden* and *JFK Reloaded* might seem to have little in common. But the games share similar goals: they seek to record an event, its space, and its stakeholders for posterity. Following their cinematic